

Appl. No. : 10/782,666
Filed : February 18, 2004

IN THE CLAIMS:

1. (Canceled) A vehicle or test stand mounted tire and wheel rim monitoring apparatus comprising:
a radar transceiver for transmitting RF signals to a rotating tire or wheel rim and for receiving RF echoes from the rotating tire or wheel rim to produce a radar output;
a processor for processing the radar output to provide an indication of a tire parameter or wheel speed.
2. (Canceled) The apparatus of claim 1 wherein the radar transceiver is a Doppler radar.
3. (Canceled) The apparatus of claim 2 wherein the Doppler radar is a pulse Doppler radar.
4. (Canceled) The apparatus of claim 2 wherein the Doppler radar is a quadrature radar.
5. (Canceled) The apparatus of claim 1 wherein the processor further comprises an alarm or display.
6. (Canceled) The apparatus of claim 1 wherein the processor output is a control signal which controls a system of a vehicle.
7. (Canceled) The apparatus of claim 1 wherein the radar transceiver is positioned so that the processor provides an indication of tire tread delamination or tire out-of-round or tire run-out conditions.
8. (Canceled) The apparatus of claim 1 wherein the radar transceiver is positioned so that the processor provides an indication of tire sidewall ballooning or tire wobble.

Appl. No. : 10/782,666
Filed : February 18, 2004

9. (Canceled) The apparatus of claim 1 wherein the radar transceiver is positioned so that the processor provides an indication of wheel rotation rate.

10. (Canceled) A method for vehicle or test stand mounted sensing of tire abnormalities or wheel speed, comprising:

transmitting RF to a rotating tire or wheel rim;

receiving RF reflections from the rotating tire or wheel rim;

processing the received RF reflections to detect a tire abnormality or wheel speed.

11. (Canceled) The method of claim 10 wherein processing the received RF reflections comprises processing Doppler reflections.

12. (Canceled) The method of claim 11 wherein processing the received RF reflections comprises processing quadrature Doppler reflections.

13. (Canceled) The method of claim 10 wherein the transmitted RF is directed to and the received RF reflections are received from a tire tread.

14. (Canceled) The method of claim 10 wherein the transmitted RF is directed to and the received RF reflections are received from a tire sidewall.

15. (Canceled) The method of claim 10 wherein the transmitted RF is directed to and the received RF reflections are received from a structural member of a wheel that casts a radar reflection that differs from the rest of the wheel.

16. (Canceled) The method of claim 10 further comprising controlling a vehicle system in response to the detected tire abnormality or wheel speed.

Appl. No. : 10/782,666
Filed : February 18, 2004

17. (Canceled) A tire or wheel monitoring apparatus comprising:
a radar transceiver positioned in a fixed relationship to rotating tire or wheel and for transmitting RF signals to the rotating tire or wheel for receiving reflected echoes from the rotating tire or wheel;
a processor connected to the radar transceiver for processing output signals from the radar transceiver to provide an indication of a tire parameter or wheel speed.
18. (Canceled) The apparatus of claim 17 wherein the radar transceiver is mounted on a vehicle.
19. (Canceled) The apparatus of claim 17 wherein the radar transceiver is mounted on a test stand.
20. (Canceled) A tire or wheel monitoring apparatus for a rotating tire having a tread and sidewalls comprising:
a radar transceiver positioned in a fixed relationship to a the rotating tire or wheel for transmitting RF signals to a selected portion of the rotating tire or wheel and for receiving reflected echoes from the selected portion of the rotating tire or wheel;
a processor connected to the radar transceiver for processing output signals from the radar transceiver to provide an indication of a tire parameter or wheel speed tread or sidewall abnormality.
21. (Canceled) The apparatus of claim 20 wherein the radar transceiver is mounted on a vehicle.
22. (Canceled) The apparatus of claim 20 wherein the radar transceiver is mounted on a test stand.

Appl. No. : 10/782,666
Filed : February 18, 2004

23. (Canceled) A tire or wheel monitoring system for vehicles, comprising:
a radar transceiver mounted on the vehicle to transmit RF signals to a rotating tire or wheel and to receive reflected echoes from the rotating tire or wheel;
a processor connected to the radar transceiver for processing output signals from the radar transceiver to provide tire condition or wheel speed information;
a vehicle control system connected to the processor to control a vehicle system in response to the tire condition or wheel speed information.

Appl. No. : 10/782,666
Filed : February 18, 2004

24. (New) A tire monitor comprising:

a structural element configured to secure the tire monitor to or within a vehicle;

a radar transmitter-receiver located on the structural element, the radar transmitter-receiver configured to:

generate a radar transmit signal;

transmit the radar transmit signal to thereby radiate the radar transmit signal toward a tire, wherein irradiating the tire with the radar transmit signal generates a reflection representative of one or more aspects of the tire;

receive the reflection and convert the reflection to an electrical signal comprising a reflection signal;

a processor configured to receive and process the reflection signal or a signal representative thereof, wherein the processing comprises:

comparing the reflection signal to a prior version of the reflection signal or a baseline signal;

responsive to the comparing, generating an alert signal if the reflecting signal varies by greater than a threshold signal from the prior version of the reflection signal or a baseline signal.

25. (New) The system of Claim 24, wherein the tire monitor is configured to monitor the tire during rotation of the tire resulting from movement of the vehicle.

26. (New) The system of Claim 24, wherein the radar transmitter receiver comprises a first antenna and a second antenna.

Appl. No. : 10/782,666
Filed : February 18, 2004

27. (New) The system of Claim 24, wherein the tire comprises a side wall and a tread, and the radar transmitter receiver is configured to irradiate the sidewall or tread.
28. (New) The system of Claim 24, wherein the radar transmit signal comprises two or more pulses and the processor is configured to integrate two or more reflections.
29. (New) A tire monitoring apparatus configured to monitor a vehicle tire having a tread and sidewalls, the apparatus comprising:
a radar transceiver for mounting on a vehicle and configured to:
transmit one or more RF signals at the vehicle tire;
receive one or more reflected echoes of the RF signal from the vehicle tire;
a processor in communication with the radar transceiver configured to process one or more of the reflected echoes to thereby monitor for a tread or sidewall abnormality.
30. (New) The apparatus of Claim 29, wherein the radar transceiver and processor are mounted on a vehicle.
31. (New) The apparatus of Claim 29, wherein the radar transceiver is mounted on a test stand.
32. (New) The apparatus of Claim 29, wherein the tire comprises rubber and wherein the processing comprising comparing the transmitted RF signal to the reflected echoes to monitor for an abnormality.
33. (New) The apparatus of Claim 29, wherein the abnormality comprises a bulge in the tire or a deformation of the tread.

Appl. No. : 10/782,666
Filed : February 18, 2004

34. (New) The apparatus of Claim 29, further comprising a vehicle control system connected to the processor to control a vehicle system in response to an indication of a tire tread or sidewall abnormality.
35. (New) The apparatus of Claim 29, wherein the vehicle control system is configured to provide a notification to a driver in response to an indication of a tire tread or sidewall abnormality.
36. (New) A method for sensing a tire abnormalities, comprising:
transmitting one or more RF signals to a rotating tire tread, tire sidewall or both;
receiving one or more RF reflections of the one or more transmitted RF signals from the rotating tire tread, tire sidewall, or both;
processing the received RF reflections to detect a tire abnormality in the tire tread, tire sidewall or both.
37. (New) The method of Claim 36, wherein processing the received RF reflections comprises processing Doppler reflections.
38. (New) The method of Claim 36, wherein processing comprises comparing the one or more RF reflections generated at a first time period to one or more RF reflections generated at a second time period to monitor for differences.
39. (New) The method of Claim 36, further comprising controlling a vehicle system in response to a detected tire tread or sidewall abnormality.
40. (New) The method of Claim 36, wherein the abnormality is selected from the group of abnormalities consisting of sidewall ballooning, tire run-out, and imbedded nails.